Inter-industry and Firm-size Wage Differentials in France and the United States

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Abstract

Two of the most pervasive and difficult to explain phenomena in economics are the persistence of inter-industry and firm-size wage differences. Some explanations predict that most of the variation is due to the persons employed in the industry or in firms of a particular size, whose opportunity wage rates are similarly high or low. Other explanations predict that most of the variation is due to differential firm or industry compensation policies that do not follow the individual from job to job. Economists' ability to distinguish among these explanations has been hampered by the lack of appropriate matched, longitudinal employer-employee data. Recent developments in Europe and in North America have allowed researchers access to this type of data. In this paper we use data from France and from the State of Washington to decompose inter-industry wage differentials and firm-size wage differentials into components due to observable characteristics, personal heterogeneity, and firm heterogeneity. We provide an exact solution to the least squares identification and estimation of these effects. We show that person effects (net of observable non-time-varying characteristics) explain about half of the raw inter-industry wage differential (net of all observable characteristics) and about 30 percent of the firm-size wage differential. Firm heterogeneity accounts for half of the raw inter-industry wage differential and about 70 percent of the firm-size wage differential. The results for France and the State of Washington are comparable with one major exception: all raw differentials are much larger in the State of Washington than they are in France. The additional variation is due primarily to additional variation in the firm heterogeneity.

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1. Motivation

Two of the most pervasive and difficult to explain phenomena in economics are the persistence of inter-industry and firm-size wage differences. Some explanations predict that most of the variation is due to the persons employed in the industry or in firms of a particular size, whose opportunity wage rates are similarly high or low. Other explanations predict that most of the variation is due to differential firm or industry compensation policies that do not follow the individual from job to job. Economists' ability to distinguish among these explanations has been hampered by the lack of appropriate matched, longitudinal employer-employee data. Recent developments in Europe and in North America have allowed researchers access to this type of data.

The analysis of inter-industry wage differentials received a flurry of attention in the 1980s when Krueger and Summers (1987, 1988) established the consistency of these differentials over time and across countries. Krueger and Summers stressed factors related to the employer, such as compensation policy, as the primary explanation of the differentials although their analysis showed that such factors were, at best, an incomplete explanation. Murphy and Topel (1987), on the other hand, stressed individual unmeasured differences as the primary cause of the wage differentials. Dickens and Katz (1987) tried to explain the inter-industry wage differentials using a variety of measured individual and firm characteristics aggregated to the industry level. Gibbons and Katz (1991) attempted to explain the differential based on unobserved individual heterogeneity. Brown and Medoff (1989) focused their attention on the firm-size wage differential. They attempted to distinguish between explanations based on individual heterogeneity and those based on firm level compensation policy. In related work Groshen (1991) examined the role of firm and establishment compensation policy heterogeneity on wage outcomes, generally.

In two related articles Abowd, Kramarz and Margolis (AKM, 1999) and Abowd, Finer and Kramarz (AFK, 1999) provided a basic statistical framework for decomposing inter-industry wage differentials and firm-size wage differentials into the sum of components due to individual heterogeneity (measured and unmeasured) and firm heterogeneity (measured and unmeasured). The first of these articles, AKM analyzes French data and finds that most of the inter-industry and the firm-size wage differentials are due to unmeasured individual heterogeneity. The second of these articles, AFK, analyzes data from the State of Washington and finds that inter-industry wage differentials are due in equal proportions to individual and employer heterogeneity while firm-size wage differentials are due primarily to firm heterogeneity.

Both AKM and AFK used statistical approximations to estimate the decomposition of wage differentials into individual and employer components. In this article we apply new methods that permit us to use the exact solution to the estimation problem. We analyze the same French data as AKM and the same American data as AFK. We find that inter-industry wage differentials are due in approximately equal proportions to individual and firm heterogeneity in both samples, with individual heterogeneity being slightly more important in the French sample. We find that firm-size wage differentials are due 70 percent to firm heterogeneity and 30 percent individual heterogeneity in both samples. Thus, the exact results exactly reproduce the approximate results for the State of Washington but change the explanation for wage differentials for France. The reason for the difference in the French results is that the computations for the approximation in AKM were limited by the capacity of the computers on which they were generated. The approximation was not sufficiently accurate. The same approximation, using more terms in the conditioning set, worked fine for the analysis of the State of Washington.

This paper is organized as follows. In section 2 we review the basic statistical model developed in AKM. Then, in section 3, we discuss the methods we used to identify and estimate the models. Section 4 discusses the inter-industry wage differential results. Section 5 discusses the firm-size wage differential results. Section 6 concludes.

2. Basic Statistical Model

The dependent variable is compensation y_{it} observed for individual i at date t and measured as a deviation from its grand mean m_y. This variable is expressed as a function of individual heterogeneity, firm heterogeneity and measured time-varying characteristics

$$y_{it} - m_y = q_i + y_{\mathrm{J}(i,t)} + (x_{it} - m_x)b + e_{it}. \tag{1}$$

There is no constant in the vector x_{it}. The function J(i,t) indicates the employer of i at date t. The first component is the individual effect, q_i. The second component is the firm effect, $y_{\mathrm{J}(i,t)}$. The third component is the effect of measured time-varying characteristics, $(x_{i,t} - m_x)b$, stated as a deviation from the grand mean of x. The fourth component is the statistical residual, e_{it} orthogonal to all other effects in the model.[1] For France the dependent variable is the sum of employee gross compensation and employer cost of benefits, stated at a full-time annual rate. For the State of Washington the dependent variable is employer reported gross employee earnings as defined by the unemployment insurance system.

In all the statistical analyses that follow, we have used the decomposition of the individual effect into an observable component related to education and sex ($u_i h$) and an unobservable individual heterogeneity component (a_i), as in AKM.

$$q_i = a_i + u_{ih}.$$

Results are reported for the unobservable component, a_i but the derivations are done using the full individual effect, q_i, for clarity.

Matrix Notation: Basic Statistical Model

In order to state the basic statistical relations more clearly we restate equation (1) in matrix format. All vectors/matrices have row dimensionality equal to the total number of

[1] See Abowd and Kramaraz (1999a and 1999b) for a more complete discussion of the exogeneity assumption for the residdual.

observations. The data are sorted by person-ID and ordered chronologically for each person. This gives the following equation for the stacked system:

$$y = Dq + Fy + Xb + e \tag{2}$$

where D is the design matrix for the person effect: columns equal to the number of unique person IDs; F is the design matrix for the firm effect: columns equal to the number of unique firm IDs times the number of effects per firm; and X is the stacked matrix of time-varying characteristics.

True Industry Effect Model

An industry effect is defined, following AKM, as a characteristic of the firm. Thus, the true industry effect is an aggregation of the firm effects in the model. What remains of the firm effects is the deviation of the firm effect from the industry effect:

$$y_{it} = q_i + (y_{\mathrm{J}(i,t)} - k_{\mathrm{K}(\mathrm{J}(i,t))}) + k_{\mathrm{K}(\mathrm{J}(i,t))} + x_{it} b + e_{it}\,. \tag{3}$$

The function K(j) indicates the industry of firm j. The first component of equation (3) is the person effect. The second component is the firm effect net of the true industry effect. The third component is the true industry effect, $k_{\mathrm{K}(\mathrm{J}(i,t))}$, an aggregation of firm effects since industry is a property of the employer. The fourth component is the measured characteristics. The fifth component is the statistical residual.

We put equation (3) into matrix form as:

$$y = Dq + FAk + (Fy - FAk) + Xb + e \tag{4}$$

The matrix A is the classification matrix that takes firms into industries. Thus, the matrix FA is the design matrix for the true industry effect. The true industry effect k can be expressed as

$$k = (A'F'FA)^{-1} A'F'Fy$$

which is just the average of the firm effects within the industry.

Raw Industry Effect Model

For comparison we show what equations (3) and (4) become when both individual and firm effects are, incorrectly, excluded from the model. We refer to such estimates as “raw” effects. They are equivalent to the regression-adjusted inter-industry wage differentials analyzed by the authors cited in the introduction.

$$y_{it} = k^{**}_{\mathrm{K}(\mathrm{J}(i,t))} + x_{it} b^{**} + e_{it} \tag{5}$$

The first component of equation (5), $k^{**}_{\mathrm{K}(\mathrm{J}(i,t))}$, is the raw industry effect. The second component is the effect of measured time-varying characteristics. The third component is the statistical residual. The raw industry effect is an aggregation of the appropriately weighted average person and average firm effects within the industry, since both have been excluded from the model. The true industry effect is only an aggregation of the appropriately weighted average firm effect within the industry, as shown above.

Industry Effects Adjusted for Person Effects Model

When only firm heterogeneity is inappropriately excluded from equation (1) we have:

$$y_{it} = k^{*}_{\mathrm{K}(i,t)} + q^{*}_{i} + x_{it} b^{*} + e_{it} \tag{6}$$

The first component of equation (6), $k^{*}_{\mathrm{K(J}(i,t))}$, is the industry effect adjusted for person effects. The second component is individual effect (with firm effects omitted). The third component is the effect of measured time-varying characteristics. The fourth component is the statistical residual. The industry effects adjusted for person effects are also biased (not equal to k) because the rest of the firm effect has been excluded. (See AKM for the relevant formula.)

Relation: True and Raw Industry Effects

AKM provide a full analysis of the relation between the three industry effects defined above. For completeness we show their basic formulas for the decomposition of the raw inter-industry wage differential into two forms. First, the formula showing the classic omitted variable bias:

$$k^{**} = k + (A'F'M_X FA)^{-1} A'F'M_X (M_{FA} Fy + Dq) \tag{7}$$

where all data have been stacked into matrices as defined in equation (2). The vector k^{**} of industry effects can be expressed as the true industry effect k plus a bias that depends upon both the person and firm effects. The matrix M is the residual matrix (column null space) after projection onto the column space of the matrix in the subscript, X, say:

$$M_X \equiv I - X(X'X)^{-1}X'$$

A more useful equation decomposes the raw inter-industry wage effect into the sum of the industry-average person effect and the industry-average firm effect, both conditional on X:

$$\begin{aligned} k^{**} &= (A'F'M_X FA)^{-1} A'F'M_X Dq \\ &\quad + (A'F'M_X FA)^{-1} A'F'M_X Fy \end{aligned} \tag{8}$$

Thus, the vector k^{**} of raw industry effects can be expressed as a matrix weighted average of the person effects q and the firm effects y. The matrix weights are related to the personal characteristics X, and the design matrices for the person and firm effects (see AKM). Equation (8) is exact if the values of q and y. are known. AKM show that if least squares estimates of these two sets of effects are used, then equation (8) provides a consistent estimate of the decomposition for the sample. In the analysis presented below we use equation (8) with exact least squares estimates of the two sets of effects (estimated simultaneously). The equation is essentially exact for both samples because the two components are estimated with great precision for each industry.

All results derived in this section also hold for firm-size wage differences. We use size categories to classify the firms into groups of similar size. The size-category classification matrix plays the role of the matrix *A* above. Thus, *FA* is the design of the firm-size effect.

3. Identification and Estimation by Fixed-effect Methods

The normal equations for least squares estimation of fixed person, firm and characteristic effects are very high dimension. Estimation of the full model by either fixed-effect or mixed-effect methods requires special algorithms to deal with the high dimensionality of the problem. In this section we present the methods we used to identify as many effects as possible and to estimate all identifiable effects in equation (2).

Least Squares Normal Equations

The full least squares solution to the basic estimation problem for equation (2) solves the following normal equations for all identified effects.

$$\begin{bmatrix} X'X & X'D & X'F \\ D'X & D'D & D'F \\ F'X & F'D & F'F \end{bmatrix} \begin{bmatrix} b \\ q \\ y \end{bmatrix} = \begin{bmatrix} X'y \\ D'y \\ F'y \end{bmatrix} \tag{9}$$

In both of our estimation samples, the cross-product matrix on the left-hand side of equation (9) is too high-dimensional to use conventional algorithms. AKM present a set of approximate solutions to (9) based on the use of different conditioning effects, *Z*. In this paper we present a method for identifying effects in (9) and estimating all such identifiable effects. Our methods are similar to those used in statistical genetics.[2]

Identification of Individual and Firm Effects

Use of the decomposition formula for the industry (or firm-size) effect in equation (8) requires a solution for the identified person, firm and characteristic effects. The usual technique of eliminating singular row/column combinations from the normal equations won't work if the least squares problem is solved directly, as we do in this paper. Identification of the person and firm effects for estimation by full least squares requires finding the conditions under which equation (9) can be solved for some subset of the person and firm effects. In this sub-section we ignore the problem of identifying the coefficients *b* because in practice this is never difficult. The problem one encounters for the person and firm effects is the necessity that some workers be mobile among the firms. To state precisely how much mobility is required, we introduce the concept of connected groups of workers and firms. When a group of workers and firms is connected, the group contains all the workers who ever worked for any of the firms in the group

[2] See Abowd and Kramarz 1999a for a longer discussion.

and all the firms at which any of the workers were ever employed. From an economic perspective, connected groups of workers and firms show the realized mobility network in the economy. From a statistical perspective, connected groups of workers and firms block diagonalize the normal equations and permit the precise statement of identification restrictions on the person and firm effects.

We first show the algorithm that constructs *G* connected groups from the *N* workers in *J* firms.

1. Firm 1 is in group *g* = 1.
2. Repeat until no more persons or firms are added:
   Add all persons employed by a firm in group 1 to group 1
   Add all firms that have employed a person in group 1 to group 1
3. For *g* = 2, ..., repeat until no firms remain:
   The first firm not assigned to a group is in group *g*.
   Repeat until no more firms or persons are added to group *g*:
      Add all persons employed by a firm in group *g* to group *g*.
      Add all firms that have employed a person in group *g* to group *g*.

At the conclusion of step 3, the persons and firms in the sample have been divided into *G* disjoint groups where every pair of workers in a given group shares at least one common employer and every pair of employers in the group shares at least one common employee.

Necessity and Sufficiency of the Grouping Conditions

Once the persons and firms have been divided into *G* groups, we want to show that exactly $N + J - G$ person and firm effects are identified (estimable). Because the matrix *X* does not include a constant, we arbitrarily group the overall constant into the person effects, thus permitting the estimation of at most *N* and *J*-1 person and firm effects. The grouping conditions imply that at most *G* group means are identified. Within each group *g*, at most N_g and J_g–1 person and firm effects are identified. Thus, the maximum number of identifiable person and firm effects is:

$$N + J - G = G + \sum_g \left(N_g + J_g - 1\right).$$

This establishes that the grouping conditions are necessary for identification.

To establish that the conditions are sufficient, consider an economy with *J* firms and *N* workers. As above, denote by E[y_{it}] the projection of worker *i*'s wage at date *t* on the column space generated by the person and firm identifiers. For simplicity, suppress the effects of observable variables *X* and write E[y_{it}] as:

$$\mathrm{E}[y_{it}] = q_i + y_{\mathrm{J}(i,t)}$$

The firms are connected into G groups, then all effects y_j, in group g are separately identified up to a constraint of the form:

$$\sum_{j\in\{\text{group}g\}} w_j y_j = 0$$

where w_j are arbitrary positive weights.

The proof is by induction. Suppose that there are 2 firms and N workers. Assume that the two firms are connected, so G=1, then at least one worker, denoted as individual 1, is employed in both firms over the sample period. Denote the projection of this worker's wage as $\mathrm{E}\lfloor y_{1t_1} \rfloor = q_1 + y_1$ at date 1 and $\mathrm{E}\lfloor y_{1t_2} \rfloor = q_1 + y_2$ at date 2. By hypothesis, there exist weights w_1 and w_2 such that

$$w_1 y_1 + w_2 y_2 = 0$$

By differencing the two projected wages one gets the second relation:

$$\mathrm{E}\lfloor y_{1t_1} \rfloor - \mathrm{E}\lfloor y_{1t_2} \rfloor = y_1 - y_2$$

Thus, exactly one firm effect is estimable.

Next, suppose there is a connected group g with J_g firms and exactly J_g-1 firm effects identified. Consider the addition of one more connected firm to such a group. Because the new firm is connected to the existing J_g firms in the group there exists at least one individual, say worker *1* who works for a firm in the identified group, say firm J_g, at date 1 and for the supplementary firm at date 2. Then, we have two relations

$$\sum_{g\le J_g} w_g y_g + w_{J_g+1} y_{J_g+1} = 0$$

and

$$\mathrm{E}\lfloor y_{1t_1} \rfloor - \mathrm{E}\lfloor y_{1t_2} \rfloor = y_{J_g} - y_{J_g+1}$$

that identify y_{J_g+1} given the hypothesized identification of J_g-1 in the original group g. Thus, the grouping conditions are both necessary and sufficient for the identification of the individual and firm effects.

Normal Equations after Group Blocking

It is, perhaps, easier to understand our identification argument by considering the normal equations after reordering the person and firm effects so that those associated with each group are placed in the design matrix in ascending order. For simplicity, let the arbitrary equation determining the unidentified firm effect simply set that effect equal to zero, i.e.

$w_{J_g} = 1$ and $w_j = 0$, for $j < J_g$. Thus, the column associated with this effect can be removed from the reorganized design matrix. The resulting normal equations are:

$$\left[\begin{array}{c|cc|cc|c|cc} X'X & X'D_1 & X'F_1 & X'D_2 & X'F_2 & \cdots & X'D_G & X'F_G \\ \hline D_1'X & D_1'D_1 & D_1'F_1 & 0 & 0 & \cdots & 0 & 0 \\ F_1'X & F_1'D_1 & F_1'F_1 & 0 & 0 & \cdots & 0 & 0 \\ \hline D_2'X & 0 & 0 & D_2'D_2 & D_2'F_2 & \cdots & 0 & 0 \\ F_2'X & 0 & 0 & F_2'D_2 & F_2'F_2 & \cdots & 0 & 0 \\ \hline \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ \hline D_G'X & 0 & 0 & 0 & 0 & \cdots & D_G'D_G & D_G'F_G \\ F_G'X & 0 & 0 & 0 & 0 & \cdots & F_G'D_G & F_G'F_G \end{array}\right] \left[\begin{array}{c} b \\ \hline q_1 \\ y_1 \\ \hline q_2 \\ y_2 \\ \hline \cdots \\ \hline q_G \\ y_G \end{array}\right] = \left[\begin{array}{c} X'y \\ \hline D_1'y \\ F_1'y \\ \hline D_2'y \\ F_2'y \\ \hline \cdots \\ \hline D_G'y \\ F_G'y \end{array}\right] \qquad (10)$$

The normal equations have a submatrix with block diagonal components. This matrix is of full rank and the solution for the parameter vector is unique. We do not solve equation (10) directly. Rather, we use the grouping to eliminate unidentified effects from equation (2). Then, we apply the algorithm discussed below to estimate the identifiable effects.

Characteristics of the Groups

Table 1 shows the results of applying our grouping algorithm to the French and Washington State data. Notice that the largest group in both data sets contains the overwhelming majority of all the identifiable person and firm effects. We could apply our methods directly to group 1 alone without much change in the statistical results. We cannot, however, use conventional methods to estimate the person and firm effects group by group because the cross-product matrix for group 1 is essentially the same size as the full set of normal equations (9).

	Largest group	*Second largest group*	*Average of all other groups*	*Total of all groups*	*Identified effects*
France					
Observations	4,682,420	51	4.4	5,305,108	
Persons	974,985	31	1.4	1,166,305	1,166,304
Firms	334,637	1	1.3	521,180	379,628
Groups	1	1	141,550	141,552	
Washington					
Observations	3,999,598	276	15.0	4,036,171	
Persons	292,945	33	1.6	296,801	296,800
Firms	81,107	3	2.0	85,864	83,436
Groups	1	1	2,426	2,428	

Notes: Largest and second largest groups are based on the number of persons in the group. Sources: Authors' calculations based on INSEE and State of Washington UI data.

Table 1
Results of Applying the Grouping Algorithm to Both Data Sets

Estimation by Direct Solution of Least Squares

Once the grouping algorithm has identified all estimable effects, we solve for the least squares estimates by direct minimization of the sum of squared residuals. This method, widely used in animal breeding and genetics research, produces a unique solution for all estimable effects, including estimates of all identifiable individual and firm effects.[3]

4. Inter-industry Wage Differentials

Summary of Data Sources

The French data are based on a collection of employer payroll reports called the Déclaration annuelles des données sociales. These consist of a 1/25th sample of French workforce with the individual and employing firm identified for the years 1976-1987 (1981 and 1983 are not available). There are 1.2 million individuals, 500,000 firms and 5.3 million observations. The time varying characteristics consist of labor force experience (quartic), time period (annual), region of France all fully interacted with sex. The non-time-varying personal characteristics consist of eight indicator variables for educational attainment, again fully interacted with sex. See AKM for a full description of the methods used to create the data and for summary statistics.

The State of Washington data are derived from unemployment insurance wage records, which are also employer reports. We use a 1/10th sample of State of Washington employment with the individual and the taxable employing entity identified for the years 1984-1993 (quarterly). There are 293,000 individuals, 80,000 firms and 4.3 million observations used. The time varying characteristics consist of labor force experience (quartic) and time period (annual and quarter) both fully interacted with sex and race. The non-time-varying personal characteristics consist of educational attainment (years), again fully interacted with sex and race. See AFK for a full description of the methods used to create the data and for summary statistics.

Main Results for Inter-industry Wage Differentials

Tables 2 and 3 present the results, by two-digit industry, for the analysis of inter-industry wage differentials for France and the State of Washington, respectively.[4] The column labeled "Raw industry effect" is the estimate of $k^{**}_{\mathrm{K}(\mathrm{J}(i,t))}$ from equation (5). The column labeled "Industry effect given persons" is the estimate of $k^{*}_{\mathrm{K}(\mathrm{J}(i,t))}$ from equation (6). The column labeled "Industry average person effect" is the estimate of $(A'F'M_X FA)^{-1} A'F'M_X Dq$ from equation (8). The column labeled "Industry average firm effect is the estimate of $(A'F'M_X FA)^{-1} A'F'M_X Fy$ from equation (8). The sum of the last two columns is theoretically equal to the first column. The estimated version of equation (8) for both data sets had an R^2 in excess of 0.98 and coefficients

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[3] We use a conjugate gradient method to solve the least squares equations. Algorithm details are available from the authors. The algorithm was developed and implemented by Robert Creecy at the Unites States Bureau of the Census.

[4] All effects were estimated; however, some effects have been suppressed from the table to avoid inappropriate disclosure of confidential data.

of 1.0 on the industry average person and firm effects. Thus, the estimates of the inter-industry wage differentials are sufficiently precise to permit a very accurate decomposition.

(appears at the end of the paper)
Table 2

(appears at the end of the paper)
Table 3

Tabular Summary of Inter-industry Wage Results

Table 4 presents a summary of the main results for inter-industry wage differentials. The table presents the wage differential variance statistic developed by Krueger and Summers (1988) as well as the exact decomposition proportions based on Tables 2 and 3. We notice that the variance of inter-industry wage differentials is much greater in Washington than in France. The vast majority of this difference is due to the fact that there are effective floors on wages in France but not in the State of Washington. Notice that the variance of the industry average person effect is similar in the two data source whereas the variance of the industry average firm effect is much greater for the State of Washington. The exact decomposition of equation (8) shows that in France 55% of inter-industry wage differentials is due to unmeasured individual heterogeneity and 45% is due to unmeasured firm heterogeneity. For the State of Washington these proportions are exactly 50% each.

Data Source	*Raw Industry Effect*	*Industry Effect Given Persons*	*Industry Average Person Effect*	*Industry Average Firm Effect*
France				
Variance	0.01073	0.00039	0.00303	0.00373
Percent			55%	45%
Washington				
Variance	0.03442	0.00976	0.00548	0.01633
Percent			50%	50%

Variance is the exact Krueger-Summers statistic. Percent is the weighted proportion of the raw effect explained by the indicated column.

Table 4
Summary of Inter-industry Wage Results

Figures 1 and 2 show the relation between raw industry effects and industry average person and firm effects, respectively, as developed in AKM. The figures show that either person or firm effects could be used to predict the raw inter-industry wage differentials with considerable precision.[5] Figures 3 and 4 show the same relations for the State of Washington.[6]

[5] Figure 2 differs substantially from the one shown in AKM because the both of the approximate solutions for the firm effects used therein are poorly correlated with the exact solution.
[6] Figures 3 and 4 are essentially identical to the results in AFK because the approximate and exact solutions are very highly correlated.

The figures are drawn to the same scale to facilitate comparisons between the two data sources. It is evident that the relations among the effects are very similar in the two data sets; however, the State of Washington data display much more data in the (-,-) quadrant, which is the direct result of the absence of wage floors in the American labor market.

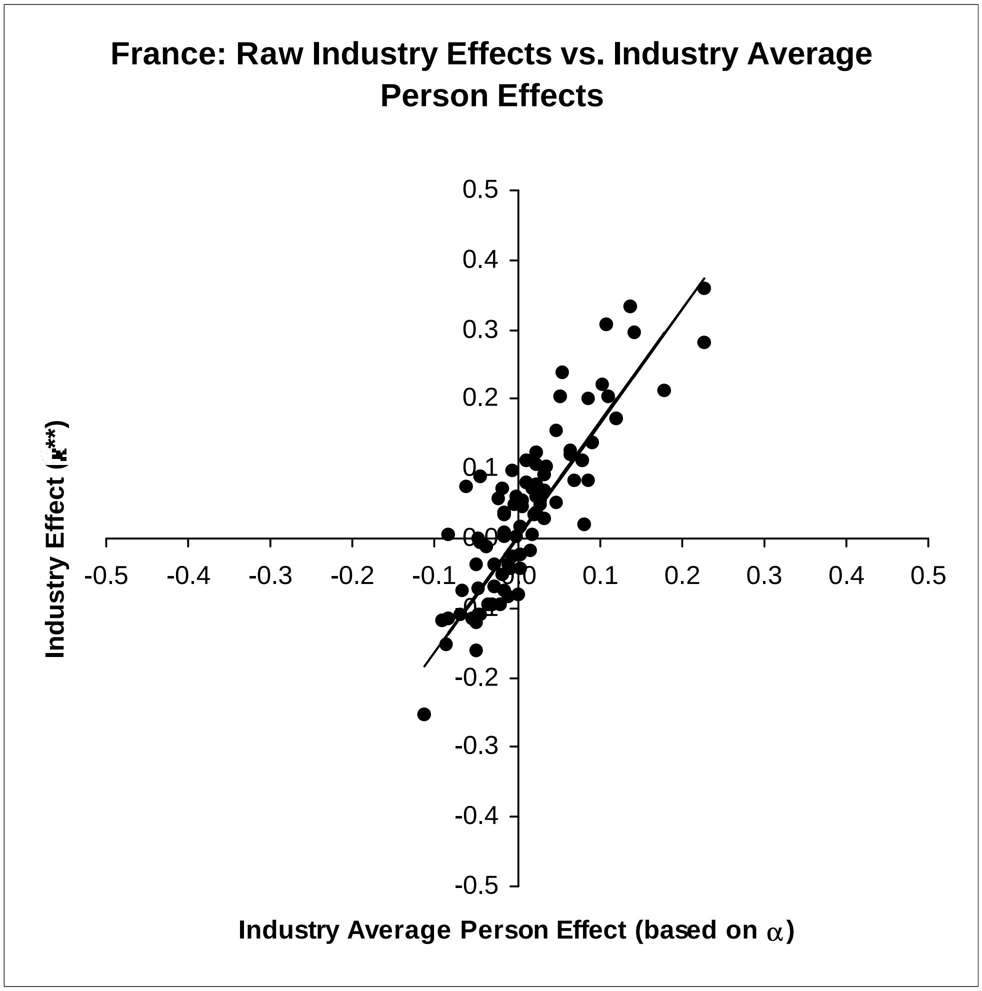


Figure 1

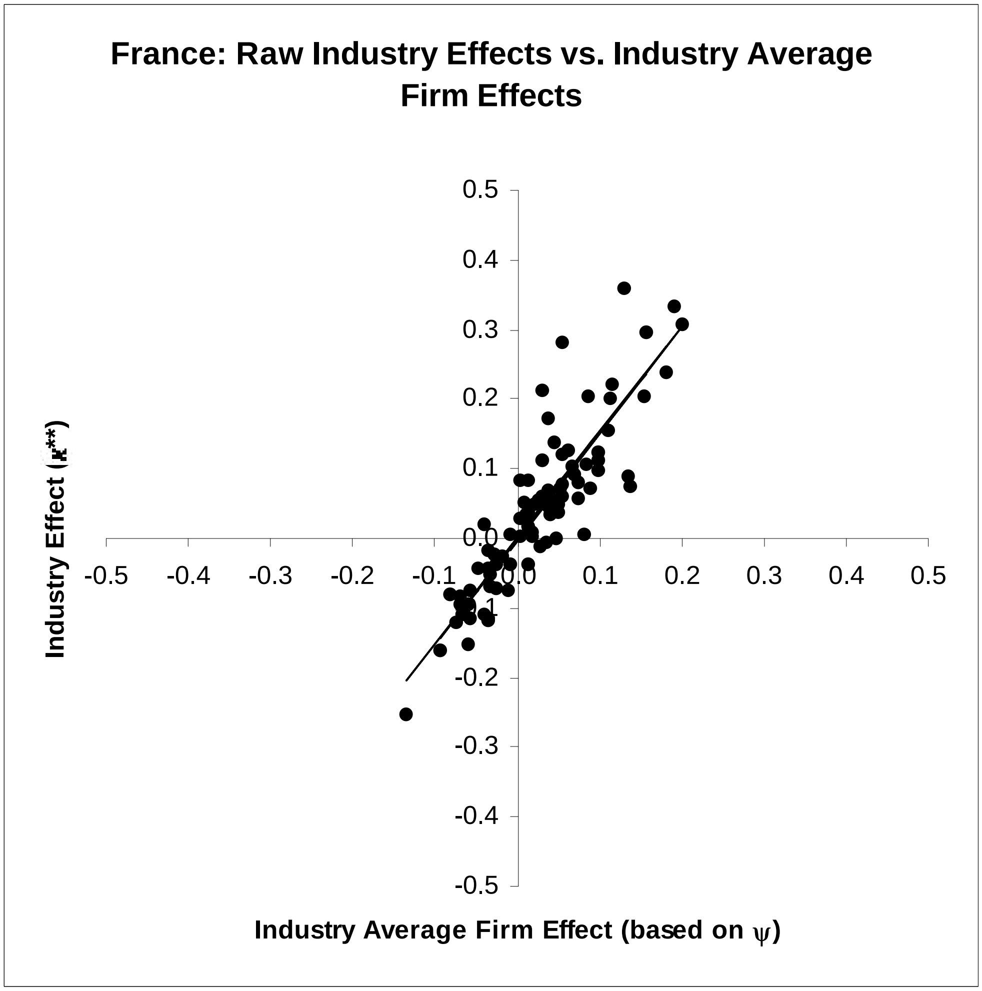
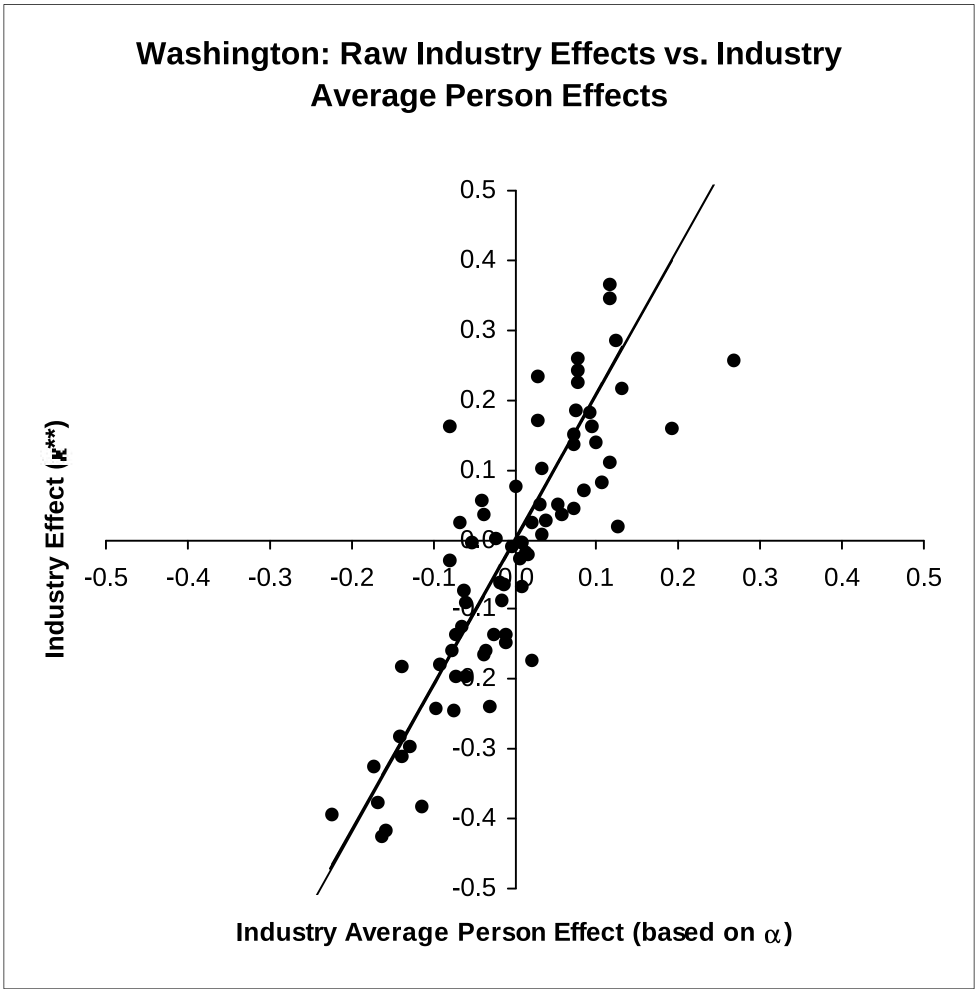

France: Raw Industry Effects vs. Industry Average Firm Effects
0.5
0.4
0.3
0.2
0.1
0.0
-0.2
-0.3
-0.4
-0.5
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
Industry Effect (κ**)
Industry Average Firm Effect (based on ψ)

Figure 2



Washington: Raw Industry Effects vs. Industry Average Person Effects
Industry Effect (κ**)
Industry Average Person Effect (based on α)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5

Figure 3

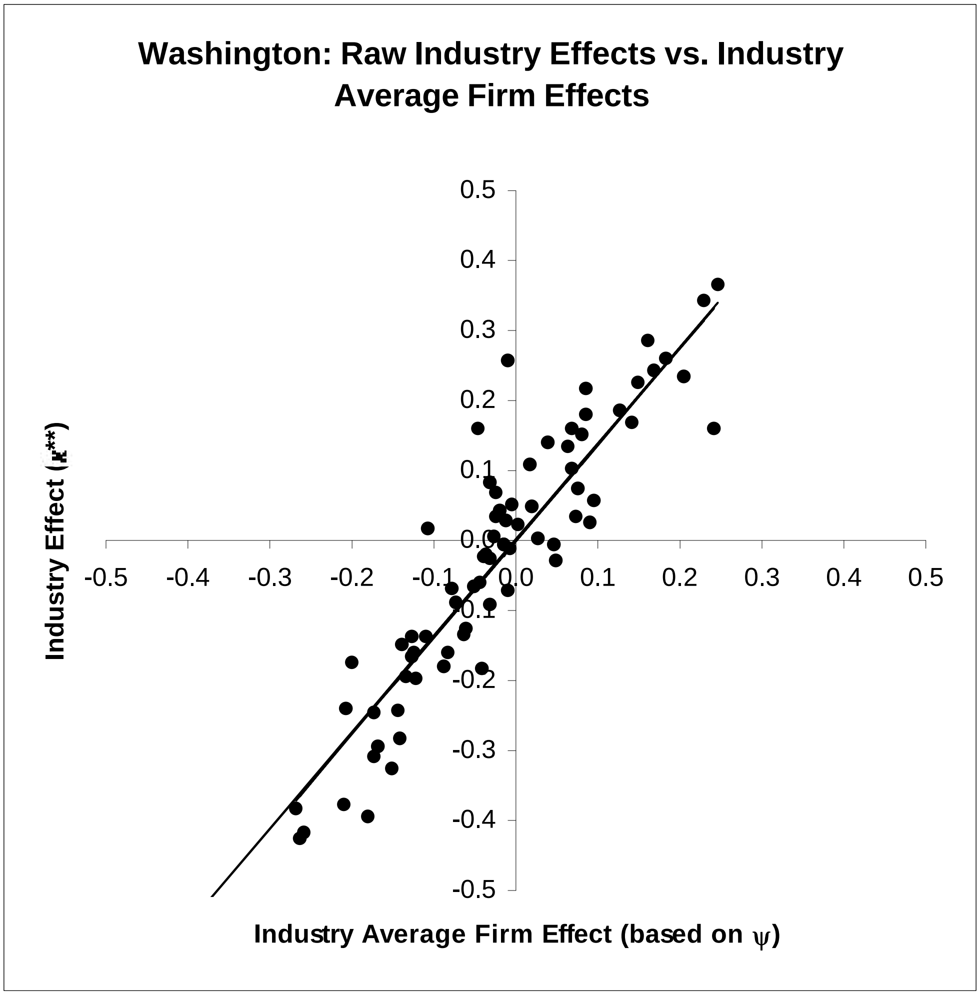
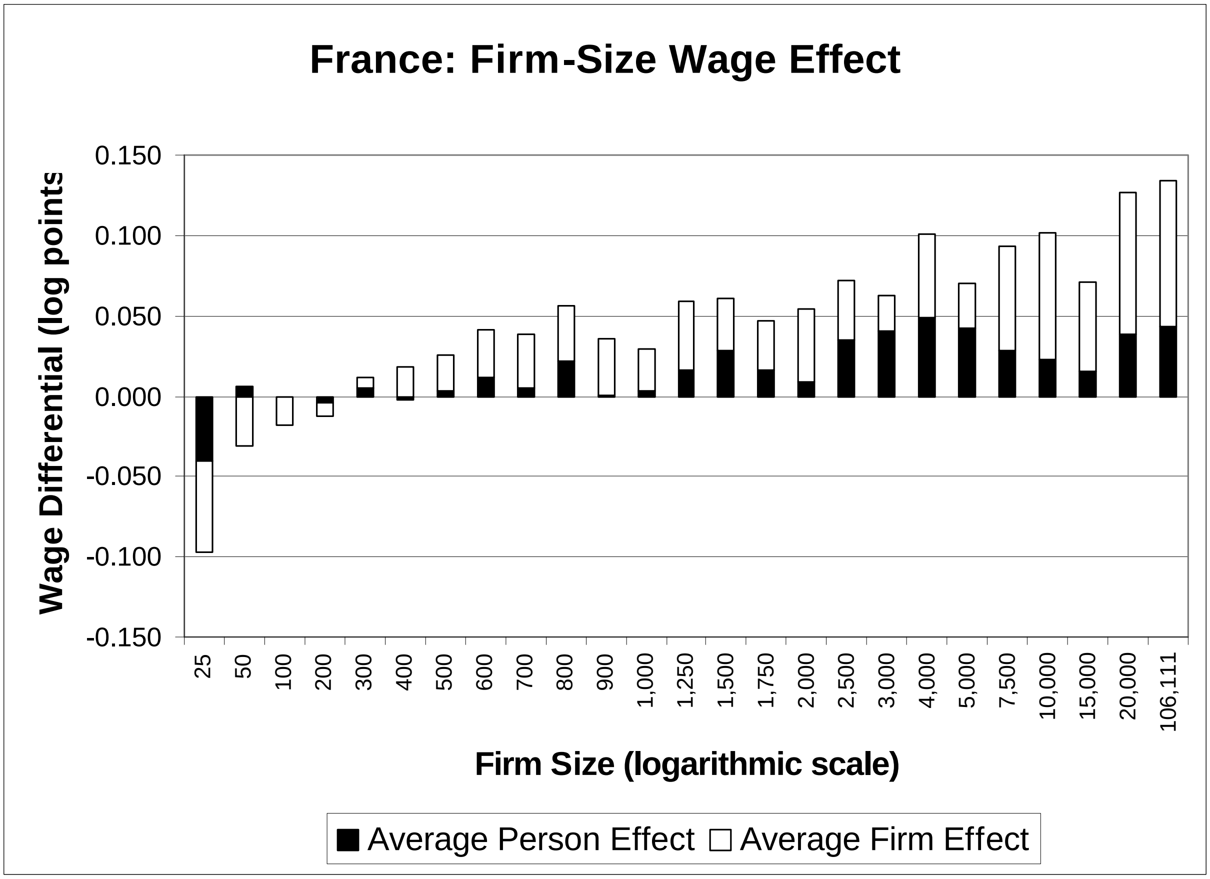


Figure 4

5. Firm-size Wage Effects

Figures 5 and 6 summarize the results for firm-size wage differentials for France and Washington, respectively. Both figures show the firm size on the horizontal axis (logarithmic scale) and the wage differential on the vertical axis. The figures are not drawn to the same scale because the firm-size differentials are much larger in Washington than in France. Both figures show the familiar (Brown and Medoff, 1989) quadratic relation between log firm size and wage differentials—increasing at a decreasing rate. In both figures the solid portion of the bar indicates the part due to the firm-size average person effect while the open part of the bar is the portion due to the firm-size average firm effect, again according to the decomposition in equation (8). For France, the firm-size average firm effect accounts for 76% of the raw firm-size wage effect and the rest is due to the firm-size average person effect. For the State of Washington, 71% of the raw firm-size wage effect is due to the firm-size average firm effect with the remainder being due to the firm-size average person effect.



France: Firm-Size Wage Effect
Wage Differential (log points
0.150
0.100
0.050
0.000
-0.050
-0.100
-0.150
25
50
100
200
300
400
500
600
700
800
900
1,000
1,250
1,500
1,750
2,000
2,500
3,000
4,000
5,000
7,500
10,000
15,000
20,000
106,111
Firm Size (logarithmic scale)
Average Person Effect
Average Firm Effect

Figure 5

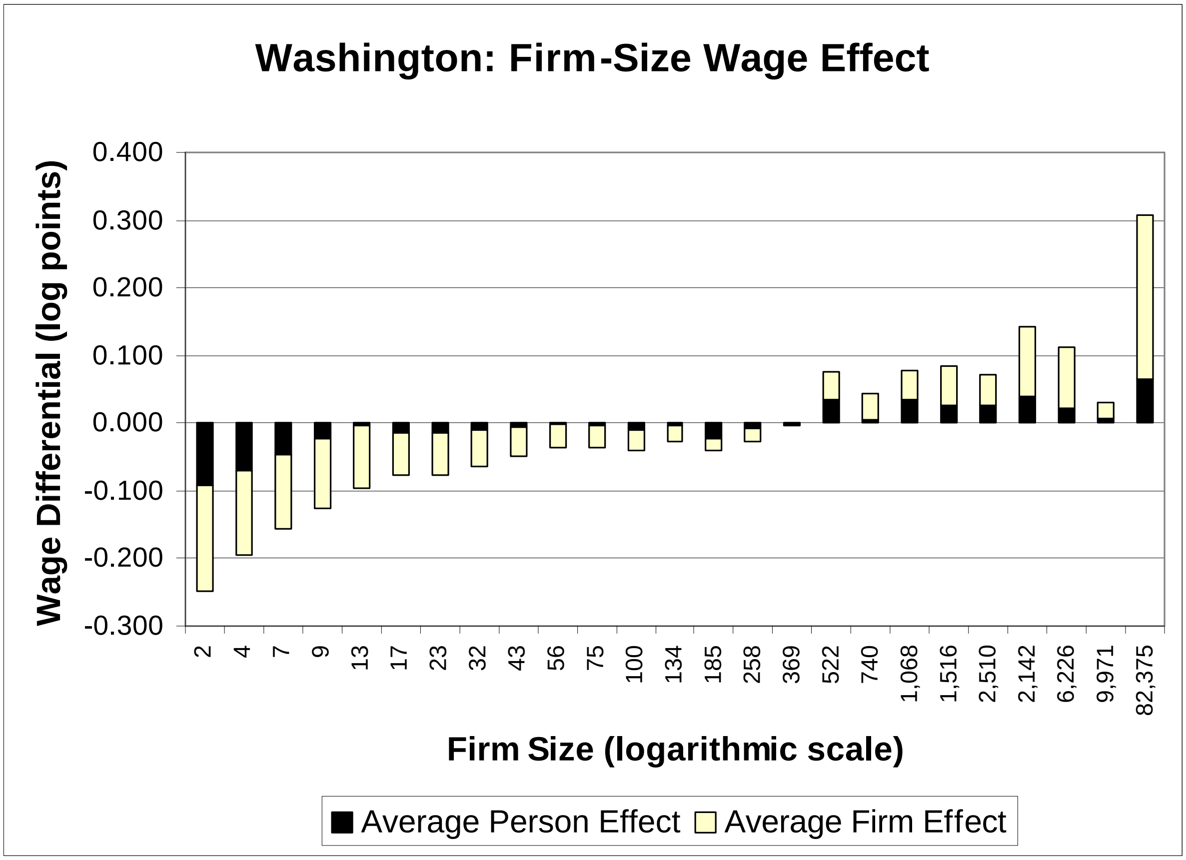


Figure 6

6. Conclusions

For both countries, raw inter-industry wage variation is well explained by either the inter-industry variation in the weighted average person effects or weighted average firm effects. The sum of the two exactly explains the differential as the relation in equation (8) shows. In France, the raw inter-industry wage variation is less strongly related to the inter-industry variation in the weighted average firm effect as compared to the State of Washington. For both samples, the raw inter-industry wage variation is essentially 50% person effect and 50% firm effect; however, the person effect is still somewhat more important in France than the firm effect. In France and in the State of Washington, firm effects are more important than person effects for explaining the firm-size wage effect (70% firm v. 30% person).

The results presented in this paper are a major challenge to theories of the labor market. Such theories must provide a role for both individual differences (wage variation that is carried from job to job) and firm differences (consistent payment of wage differentials to individuals with the same observed and unobserved characteristics). The dominance of the person effect in France is primarily a high-wage phenomenon. Collective bargaining agreements eliminate or greatly reduce wage differentials for low to mid-wage workers. In the State of Washington the variance of wage differentials is greater than in France, so the firm effects add to rather than replace the variability due to personal differences. Unobserved personal characteristics may imply that there is an interaction of person and firm effects. The interaction would permit some types of specific capital to be rewarded. On average, this would appear as a firm effect if the interaction is suppressed and the specificity is related to the industry or the firm-size.

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Table 2
Inter-industry Wage Differentials for France

SIC	Industry (Translation of the NAP-100)	Raw Industry Effect	(SE)	Industry Effect Given Persons	(SE)	Industry Average Person Effect	(SE)	Industry Average Firm Effect	(SE)
04	Coal mining	0.297	(0.006)	0.172	(0.014)	0.141	(0.005)	0.156	(0.004)
05	Crude petroleum and natural gas extraction	0.358	(0.003)	-0.009	(0.006)	0.226	(0.003)	0.130	(0.002)
06	Electricity production and supply	0.203	(0.002)	-0.060	(0.004)	0.053	(0.002)	0.155	(0.001)
08	Water and city-heating supply	0.137	(0.004)	-0.007	(0.008)	0.091	(0.004)	0.045	(0.003)
10	Iron and steel foundries	0.097	(0.002)	0.016	(0.005)	-0.006	(0.002)	0.100	(0.001)
11	Primary metal manufacturing	-0.011	(0.003)	-0.007	(0.006)	-0.039	(0.003)	0.029	(0.002)
13	Primary nonmetallic manufacturing	0.106	(0.003)	-0.023	(0.005)	0.023	(0.002)	0.084	(0.002)
14	Miscellaneous mineral production	0.049	(0.008)	0.029	(0.012)	-0.005	(0.007)	0.049	(0.005)
15	Cement, stone, and concrete products	-0.037	(0.002)	0.004	(0.003)	-0.029	(0.002)	-0.010	(0.001)
16	Glass and glass products	0.123	(0.003)	0.000	(0.005)	0.023	(0.002)	0.098	(0.002)
17	Basic chemical manufacture	0.201	(0.002)	-0.001	(0.004)	0.086	(0.002)	0.114	(0.001)
18	Allied chemical products, soaps, cosmetics	0.122	(0.002)	0.004	(0.003)	0.063	(0.002)	0.056	(0.001)
19	Pharmaceuticals	0.156	(0.003)	-0.021	(0.004)	0.048	(0.002)	0.111	(0.002)
20	Foundries and smelting works	0.010	(0.002)	0.044	(0.004)	-0.016	(0.002)	0.019	(0.002)
21	Metal works	0.003	(0.001)	-0.002	(0.002)	0.000	(0.001)	0.003	(0.001)
22	Farm machinery and equipment	-0.007	(0.003)	0.000	(0.005)	-0.044	(0.003)	0.034	(0.002)
23	Metalworking machinery manufacture	0.060	(0.003)	0.026	(0.004)	0.023	(0.002)	0.032	(0.002)
24	Industrial machinery manufacture	0.055	(0.001)	0.003	(0.002)	0.029	(0.001)	0.025	(0.001)
25	Material handling machines and equipment	0.061	(0.003)	0.019	(0.004)	0.000	(0.002)	0.056	(0.002)
26	Ordnance	0.093	(0.008)	-0.035	(0.012)	0.033	(0.007)	0.068	(0.005)
27	Office and accounting machines	0.333	(0.003)	0.012	(0.005)	0.138	(0.003)	0.190	(0.002)
28	Electrical machinery equipment	0.046	(0.001)	0.022	(0.003)	0.005	(0.001)	0.037	(0.001)
29	Electronic computing equipment	0.071	(0.001)	-0.007	(0.003)	0.018	(0.001)	0.053	(0.001)
30	Household appliances	-0.001	(0.003)	0.004	(0.005)	-0.048	(0.003)	0.046	(0.002)
31	Motor vehicles, trains, land transport man.	0.058	(0.001)	0.040	(0.003)	-0.023	(0.001)	0.075	(0.001)
32	Ship and boat building	0.105	(0.003)	0.032	(0.006)	0.034	(0.003)	0.067	(0.002)
33	Aircraft and parts manufacture	0.220	(0.002)	0.014	(0.005)	0.104	(0.002)	0.115	(0.001)
34	Professional and scientific equipment man.	0.034	(0.002)	0.016	(0.004)	0.020	(0.002)	0.012	(0.001)
35	Meat products	-0.019	(0.002)	-0.002	(0.004)	0.017	(0.002)	-0.034	(0.002)
36	Dairy products	0.053	(0.003)	0.013	(0.005)	0.005	(0.002)	0.044	(0.002)
37	Canned and preserved products	-0.038	(0.004)	0.000	(0.005)	-0.050	(0.003)	0.013	(0.002)
38	Bakery products	-0.082	(0.002)	0.000	(0.004)	-0.011	(0.002)	-0.069	(0.001)
39	Grain mill and cereal products	0.038	(0.003)	0.023	(0.005)	-0.015	(0.002)	0.050	(0.002)
40	Miscellaneous food preparations	0.073	(0.003)	0.006	(0.004)	-0.019	(0.002)	0.090	(0.002)

Table 2
Inter-industry Wage Differentials for France

SIC	Industry (Translation of the NAP-100)	Raw Industry Effect	(SE)	Industry Effect Given Persons	(SE)	Industry Average Person Effect	(SE)	Industry Average Firm Effect	(SE)
41	Beverage industries	0.112	(0.003)	-0.009	(0.005)	0.012	(0.003)	0.100	(0.002)
42	Tobacco products manufacture	0.238	(0.007)	-0.046	(0.020)	0.055	(0.007)	0.181	(0.005)
43	Knitting mills, threads and artificial fibers	0.073	(0.007)	0.015	(0.012)	-0.063	(0.006)	0.137	(0.004)
44	Textile products	-0.076	(0.001)	0.013	(0.003)	-0.066	(0.001)	-0.011	(0.001)
45	Leather products except footwear	-0.109	(0.004)	0.019	(0.006)	-0.048	(0.003)	-0.064	(0.002)
46	Footwear	-0.081	(0.003)	0.006	(0.006)	0.001	(0.002)	-0.081	(0.002)
47	Apparel, clothing and allied products	-0.115	(0.001)	0.002	(0.003)	-0.056	(0.001)	-0.057	(0.001)
48	Lumber mills	-0.110	(0.002)	0.005	(0.004)	-0.069	(0.002)	-0.040	(0.001)
49	Furniture and fixtures manufacture	-0.096	(0.002)	0.006	(0.004)	-0.035	(0.002)	-0.060	(0.001)
50	Pulp and paper mills and packaging prod.	0.078	(0.002)	0.003	(0.004)	0.022	(0.002)	0.054	(0.001)
51	Printing and publishing	0.125	(0.001)	-0.011	(0.003)	0.064	(0.001)	0.061	(0.001)
52	Rubber products	0.034	(0.002)	0.044	(0.004)	-0.015	(0.002)	0.040	(0.001)
53	Plastic products	0.003	(0.002)	-0.001	(0.003)	-0.016	(0.002)	0.019	(0.001)
54	Miscellaneous manufacturing industries	-0.071	(0.002)	0.000	(0.003)	-0.047	(0.002)	-0.024	(0.001)
55	Construction	-0.122	(0.001)	0.006	(0.002)	-0.049	(0.001)	-0.074	(0.000)
56	Waste product management	-0.116	(0.005)	0.010	(0.006)	-0.083	(0.004)	-0.035	(0.003)
57	Wholesale food trade	-0.024	(0.001)	-0.004	(0.002)	-0.006	(0.001)	-0.019	(0.001)
58	Wholesale non-food trade	0.005	(0.001)	-0.023	(0.002)	0.018	(0.001)	-0.008	(0.001)
59	Inter-industry wholesale trade	0.052	(0.001)	-0.012	(0.002)	0.047	(0.001)	0.008	(0.001)
60	Commercial intermediaries	0.084	(0.003)	-0.026	(0.004)	0.086	(0.002)	0.005	(0.002)
61	Retail food and supermarkets	-0.051	(0.002)	0.018	(0.003)	-0.019	(0.002)	-0.033	(0.001)
62	Retail specialty and neighborhood food	-0.110	(0.001)	0.012	(0.002)	-0.045	(0.001)	-0.066	(0.001)
63	Retail general merchandise and non food	-0.044	(0.002)	0.004	(0.004)	-0.008	(0.002)	-0.036	(0.002)
64	Retail specialty non food trade	-0.074	(0.001)	-0.019	(0.002)	-0.015	(0.001)	-0.056	(0.001)
65	Automobile dealers, auto parts and repair	-0.043	(0.001)	-0.001	(0.002)	0.004	(0.001)	-0.048	(0.001)
66	Miscellaneous repair services	-0.095	(0.005)	-0.034	(0.006)	-0.021	(0.004)	-0.060	(0.003)
67	Hotels, motels, bars and restaurants	-0.151	(0.001)	-0.004	(0.002)	-0.087	(0.001)	-0.060	(0.001)
68	Railroad transportation	0.090	(0.001)	-0.010	(0.005)	-0.046	(0.001)	0.134	(0.001)
69	Bus, taxicab and other urban transit	-0.039	(0.001)	-0.021	(0.002)	-0.010	(0.001)	-0.025	(0.001)
70	Inland water transportation	0.005	(0.013)	0.051	(0.017)	-0.084	(0.012)	0.081	(0.008)
71	Marine transport and coastal shipping	0.203	(0.007)	0.021	(0.012)	0.110	(0.006)	0.086	(0.005)
72	Air transportation	0.309	(0.003)	-0.035	(0.007)	0.107	(0.003)	0.200	(0.002)
73	Allied transportation and warehousing	0.069	(0.004)	-0.009	(0.006)	0.032	(0.003)	0.037	(0.002)
74	Travel agencies	0.018	(0.002)	-0.010	(0.003)	0.004	(0.002)	0.014	(0.001)

Table 2
Inter-industry Wage Differentials for France

SIC	Industry (Translation of the NAP-100)	Raw Industry Effect	(SE)	Industry Effect Given Persons	(SE)	Industry Average Person Effect	(SE)	Industry Average Firm Effect	(SE)
75	Telecommunications and postal	0.019	(0.008)	-0.021	(0.010)	0.080	(0.007)	-0.039	(0.005)
76	Financial holding companies	0.282	(0.006)	0.005	(0.006)	0.226	(0.006)	0.055	(0.004)
77	Advertising and consulting services	0.028	(0.001)	-0.024	(0.002)	0.032	(0.001)	0.003	(0.001)
78	Brokers, credit agencies, and insurance	0.083	(0.003)	-0.001	(0.005)	0.070	(0.003)	0.012	(0.002)
79	Commercial real estate development, sales	-0.069	(0.002)	-0.029	(0.003)	-0.028	(0.002)	-0.032	(0.001)
80	Nonresidential goods rental services	0.038	(0.004)	-0.002	(0.004)	0.023	(0.003)	0.014	(0.002)
81	Real estate renting and leasing	-0.096	(0.003)	0.004	(0.003)	-0.029	(0.002)	-0.070	(0.002)
82	Commercial education services	-0.160	(0.005)	-0.052	(0.006)	-0.051	(0.005)	-0.094	(0.003)
83	Commercial research services	0.174	(0.007)	0.022	(0.008)	0.121	(0.006)	0.039	(0.004)
84	Commercial health services	0.050	(0.001)	-0.015	(0.002)	0.029	(0.001)	0.021	(0.000)
85	Commercial social services	-0.119	(0.002)	0.027	(0.003)	-0.091	(0.002)	-0.036	(0.001)
86	Commercial entertainment and recreation	0.079	(0.003)	-0.031	(0.004)	0.011	(0.002)	0.074	(0.002)
87	Miscellaneous commercial services	-0.252	(0.001)	-0.029	(0.003)	-0.112	(0.001)	-0.135	(0.001)
88	Insurance carriers	0.112	(0.002)	0.019	(0.003)	0.079	(0.002)	0.030	(0.001)
89	Banks and financial institutions	0.214	(0.001)	0.037	(0.003)	0.180	(0.001)	0.030	(0.001)
90	Public Administration	-0.023	(0.001)	0.020	(0.002)	0.002	(0.001)	-0.028	(0.001)
	Weighted adjusted standard deviation	0.104		0.020		0.055		0.061	
	Weighted adjusted variance	0.01073		0.00039		0.00303		0.00373	

Table 3
Inter-industry Wage Differentials for the United States (State of Washington)

SIC	***Industry (1987 SIC)***	***Raw Industry Effect***	***(SE)***	***Industry Effect Given Persons***	***(SE)***	***Industry Average Person Effect***	***(SE)***	***Industry Average Firm Effect***	***(SE)***
01	Agriculture-crops	-0.417	(0.002)	-0.185	(0.006)	-0.159	(0.002)	-0.258	(0.001)
02	Agriculture-livestock	-0.296	(0.004)	-0.099	(0.007)	-0.127	(0.004)	-0.169	(0.002)
07	Agricultural services	-0.243	(0.003)	-0.079	(0.006)	-0.097	(0.002)	-0.145	(0.001)
08	Forestry	-0.073	(0.008)	0.036	(0.009)	-0.061	(0.007)	-0.011	(0.004)
09	Fishing	0.170	(0.005)	0.076	(0.007)	0.028	(0.004)	0.141	(0.002)
12	Bituminous coal mining	0.344	(0.008)	0.176	(0.018)	0.115	(0.007)	0.229	(0.004)
14	Nonmetal mineral mining	0.075	(0.007)	0.059	(0.008)	0.000	(0.006)	0.076	(0.003)
15	Building contractors	0.151	(0.002)	0.061	(0.006)	0.072	(0.002)	0.080	(0.001)
16	Heavy construction	0.259	(0.002)	0.124	(0.006)	0.077	(0.002)	0.182	(0.001)
17	Special trade contractors	0.136	(0.001)	0.057	(0.006)	0.072	(0.001)	0.063	(0.001)
20	Food and tobacco manufacturing	-0.029	(0.001)	0.052	(0.006)	-0.079	(0.001)	0.050	(0.001)
22	Textile mill products	-0.181	(0.007)	-0.046	(0.009)	-0.139	(0.006)	-0.042	(0.003)
23	Apparel	-0.325	(0.003)	-0.107	(0.007)	-0.172	(0.003)	-0.152	(0.002)
24	Lumber and wood	0.025	(0.001)	0.076	(0.006)	-0.067	(0.001)	0.089	(0.001)
25	Furniture and fixtures	-0.160	(0.004)	-0.043	(0.007)	-0.076	(0.004)	-0.084	(0.002)
26	Paper and allied products	0.243	(0.002)	0.098	(0.006)	0.076	(0.001)	0.167	(0.001)
27	Printing and publishing	-0.011	(0.002)	-0.025	(0.006)	-0.003	(0.002)	-0.008	(0.001)
28	Chemicals and allied products	0.225	(0.002)	0.019	(0.006)	0.077	(0.002)	0.150	(0.001)
29	Petroleum and coal products	0.365	(0.005)	0.204	(0.010)	0.116	(0.004)	0.246	(0.002)
30	Rubber and plastics	-0.126	(0.003)	-0.037	(0.006)	-0.064	(0.003)	-0.061	(0.001)
31	Leather	-0.393	(0.011)	-0.112	(0.011)	-0.223	(0.009)	-0.180	(0.005)
32	Stone, clay and glass	0.035	(0.003)	0.059	(0.006)	-0.039	(0.002)	0.074	(0.001)
33	Primary metals	0.161	(0.002)	0.211	(0.006)	-0.080	(0.002)	0.241	(0.001)
34	Fabricated metals	0.003	(0.002)	0.018	(0.006)	-0.024	(0.002)	0.026	(0.001)
35	Machinery, except electrical	-0.005	(0.002)	0.016	(0.006)	0.008	(0.002)	-0.014	(0.001)
36	Electric and electronic equipment	-0.065	(0.002)	-0.034	(0.006)	-0.014	(0.002)	-0.051	(0.001)
38	Instruments and related products	0.161	(0.002)	0.012	(0.006)	0.094	(0.002)	0.068	(0.001)
39	Miscellaneous manufacturing	-0.136	(0.003)	-0.028	(0.007)	-0.071	(0.003)	-0.063	(0.001)
41	Local and interurban passenger transport	0.056	(0.003)	0.028	(0.007)	-0.040	(0.002)	0.096	(0.001)
42	Trucking and warehousing	-0.005	(0.002)	0.042	(0.006)	-0.052	(0.002)	0.047	(0.001)
44	Water transportation	0.284	(0.002)	0.060	(0.007)	0.123	(0.002)	0.162	(0.001)
45	Air transportation	0.017	(0.002)	-0.033	(0.006)	0.125	(0.002)	-0.108	(0.001)
47	Transportation services	-0.068	(0.003)	-0.053	(0.006)	0.009	(0.002)	-0.078	(0.001)
48	Communication	0.233	(0.002)	0.067	(0.006)	0.029	(0.001)	0.205	(0.001)

Table 3
Inter-industry Wage Differentials for the United States (State of Washington)

SIC	*Industry (1987 SIC)*	*Raw Industry Effect*	*(SE)*	*Industry Effect Given Persons*	*(SE)*	*Industry Average Person Effect*	*(SE)*	*Industry Average Firm Effect*	*(SE)*
49	Electric, gas and sanitary services	0.217	(0.002)	0.063	(0.006)	0.132	(0.001)	0.085	(0.001)
50	Wholesale trade-durable goods	0.007	(0.001)	-0.012	(0.006)	0.032	(0.001)	-0.026	(0.000)
51	Wholesale trade-nondurable goods	-0.027	(0.001)	-0.017	(0.006)	0.006	(0.001)	-0.032	(0.001)
52	Building materials and garden supplies	-0.196	(0.002)	-0.084	(0.006)	-0.072	(0.002)	-0.121	(0.001)
53	General merchandise stores	-0.179	(0.001)	-0.073	(0.006)	-0.090	(0.001)	-0.088	(0.001)
54	Food stores	-0.195	(0.001)	-0.125	(0.006)	-0.061	(0.001)	-0.134	(0.001)
55	Automobile dealers and service stations	-0.137	(0.001)	-0.108	(0.006)	-0.011	(0.001)	-0.126	(0.001)
56	Apparel and accessory stores	-0.090	(0.002)	-0.054	(0.006)	-0.059	(0.002)	-0.031	(0.001)
57	Furniture and home furnishing stores	-0.159	(0.002)	-0.096	(0.006)	-0.035	(0.002)	-0.123	(0.001)
58	Eating and drinking places	-0.427	(0.001)	-0.230	(0.006)	-0.161	(0.001)	-0.265	(0.001)
59	Miscellaneous retail	-0.246	(0.002)	-0.124	(0.006)	-0.074	(0.001)	-0.172	(0.001)
60	Banking	-0.020	(0.001)	-0.018	(0.006)	0.014	(0.001)	-0.035	(0.001)
61	Credit agencies other than banks	0.044	(0.003)	-0.033	(0.006)	0.071	(0.002)	-0.019	(0.001)
62	Security, commodity, brokers and services	0.258	(0.004)	-0.005	(0.007)	0.268	(0.003)	-0.010	(0.002)
63	Insurance carriers	0.050	(0.002)	0.012	(0.006)	0.031	(0.001)	0.018	(0.001)
64	Insurance agents and brokers	0.035	(0.003)	0.000	(0.006)	0.058	(0.002)	-0.024	(0.001)
65	Real estate	-0.164	(0.002)	-0.086	(0.006)	-0.037	(0.002)	-0.127	(0.001)
67	Holding and other investments	0.160	(0.005)	-0.001	(0.006)	0.191	(0.004)	-0.046	(0.002)
70	Hotel and lodging services	-0.377	(0.002)	-0.181	(0.006)	-0.167	(0.002)	-0.210	(0.001)
72	Personal services	-0.283	(0.002)	-0.110	(0.006)	-0.142	(0.002)	-0.141	(0.001)
73	Business services	-0.060	(0.001)	-0.046	(0.006)	-0.017	(0.001)	-0.043	(0.001)
75	Auto repair services and garages	-0.137	(0.002)	-0.086	(0.006)	-0.026	(0.002)	-0.111	(0.001)
76	Miscellaneous repair	-0.088	(0.003)	-0.040	(0.006)	-0.015	(0.003)	-0.072	(0.002)
78	Motion pictures	-0.384	(0.006)	-0.261	(0.007)	-0.115	(0.005)	-0.269	(0.003)
79	Amusement and recreation services	-0.239	(0.003)	-0.153	(0.006)	-0.030	(0.002)	-0.208	(0.001)
80	Health services	-0.023	(0.001)	-0.027	(0.006)	0.015	(0.001)	-0.038	(0.000)
81	Legal services	0.139	(0.002)	0.037	(0.006)	0.099	(0.002)	0.040	(0.001)
82	Educational services	0.024	(0.001)	0.030	(0.006)	0.021	(0.001)	0.003	(0.000)
83	Social services	-0.310	(0.002)	-0.114	(0.006)	-0.137	(0.001)	-0.173	(0.001)
84	Museums, botanical, zoological gardens	-0.173	(0.011)	-0.146	(0.013)	0.021	(0.010)	-0.199	(0.005)
86	Membership organizations	-0.148	(0.002)	-0.089	(0.006)	-0.010	(0.002)	-0.138	(0.001)
87	Engineering, accounting, research services	0.181	(0.001)	0.040	(0.006)	0.091	(0.001)	0.084	(0.001)
88	Private households	-0.761	(0.004)	-0.417	(0.007)	-0.225	(0.004)	-0.535	(0.002)
89	Miscellaneous services	0.110	(0.003)	-0.025	(0.006)	0.115	(0.003)	0.018	(0.002)

Table 3
Inter-industry Wage Differentials for the United States (State of Washington)

SIC	Industry (1987 SIC)	Raw Industry Effect	(SE)	Industry Effect Given Persons	(SE)	Industry Average Person Effect	(SE)	Industry Average Firm Effect	(SE)
91	Executive, legislative and general	0.102	(0.001)	0.094	(0.006)	0.033	(0.001)	0.068	(0.000)
92	Justice, public order	0.069	(0.003)	0.088	(0.007)	0.085	(0.002)	-0.023	(0.001)
93	Finance, taxation and monetary policy	0.082	(0.007)	0.064	(0.010)	0.108	(0.006)	-0.031	(0.003)
94	Administration of human resources	0.029	(0.002)	0.075	(0.006)	0.037	(0.002)	-0.013	(0.001)
95	Environmental quality and housing	-0.004	(0.004)	0.042	(0.007)	0.008	(0.003)	-0.016	(0.002)
96	Administration of economic programs	0.051	(0.003)	0.050	(0.007)	0.053	(0.003)	-0.004	(0.001)
97	National security	-0.580	(0.004)	-0.399	(0.006)	-0.293	(0.003)	-0.219	(0.002)
	Weighted adjusted standard deviation	0.1855		0.0988		0.0740		0.1278	
	Weighted adjusted variance	0.0344		0.0098		0.0055		0.0163	